Remarks

In regard to 35 U.S.C. §112 (Paragraphs 2, 3 and 4 of the Official Action), we have revised the claims as suggested by the Examiner and trust the revisions of Claims 13, 20 and 35-44 will be found formally appropriate. In regard to the grain size, we have amended the specification, page 7, paragraph 16, for clarity, and in regard to the intended use of the apparatus, we have removed "for producing a plasma display" from Claims 35 and 44. We have also made the suggested revision of Claim 3, and appreciate the Examiner's assistance.

The limitation "at a pitch of 360 μm or less" is supported in the Examples; Example 9 shows the 360 μm limitation.

The expression "formed in a line of 288 mm or more" is supported in Examples 8 and 10. Of course, "in line" may be a single line or plural lines, as disclosed. Please note that the distance between the remotest holes of the paste applicator in Examples 8 and 10 is 288 mm. Example 9 shows a paste applicator having a plurality of outlet holes formed in line of 698 mm in length, much more than 288 mm.

In Paragraph 6 of the Official Action, Claims 1-2, 4, 9, 16, 22, and 31 are rejected under 35 U.S.C. 102 as being anticipated by Shinoda '553.

In Paragraph 8 of the Official Action, Claims 3, 5-7, 11, 21, 26 and 30 are rejected under 35 U.S.C. 103(a) as being unpatentable over Shinoda '553.

In Paragraph 9 of the Official Action, Claims 20 and 27 are rejected under USC 35 103(a) as applied to Claims 1 and 2 above, and further in view of Osaka et al. '840.

In Paragraph 10 of the Official Action, Claims 28 and 29 are rejected under U.S.C. 103(a) as being unpatentable over Shinoda '553 as applied to Claims 1 and 2 above, and further in veiw of Yamaura et al. '231.

However, Shinoda '553 fails to disclose, teach or suggest a *paste applicator having a plurality of outlet holes formed in line of 288 mm or more*, which is an essential feature of the claimed invention. Accordingly, Shinoda '553 is inapplicable under §§ 102 or 103. Withdrawal of all rejections based in whole or in part on Shinoda '553 is respectfully

requested.

Also, both of Osaka '840 and Yamaura'231 fail to teach a *paste applicator having a plurality of outlet holes formed in line of 288 mm or more*, which is now an essential feature of the claimed invention. Withdrawal of the rejections based on Osaka '840 and Yamaura '231 is respectfully requested.

In Paragraph 11 of the Official Action, the Examiner rejected Claims 1-2, 4, 9, 16, 22 and 31 under 35 U.S.C. §103(a) over Nanto '836 in view of Shinoda '533.

In Paragraph 12 of the Official Action, the Examiner rejected Claims 33, 35, 37-41, 43-44, 48-49, 51, 53-56 and 58 under 35 U.S.C. §103(a) over Nanto '836 as applied to Claims 1-2 above, and further in view of Ravi-Chandar et al. '574.

In Paragraph 13 of the Official Action, Claim 10 is rejected under 35 USC §103(a) as being unpatentable over Nanto '836 in view of Shinoda '553 as applied to Claim 1 and further in view of Ravi-Chandar '574 for the same reasons that is applied to Claim 33.

In Paragraph 14 of the Official Action, Claim 50 is rejected under 35 U.S.C. §103(a) as being unpatentable over Nanto '836 in view of Ravi-Chandar '574 as applied to Claim 33 and further in veiw of Mettenbrink '080.

In Paragraph 15 of the Official Action, Claim 18 is rejected under 35 U.S.C. §103(a) as being unpatentable over Nanto '836 in view of Shinoda '553 as applied to Claim 1 above and further in view of Mettenbrink '080 for substantially the same reasons as given for Claim 50 above.

In Paragraph 16 of the Official Action, Claims 20 and 27 are rejected under 35 USC §103(a) as being unpatentable over Nanto '836 in view of Shinoda '553 as applied to Claim 1 and further in view of Osaka '840.

In Paragraph 17 of the Official Action, Claim 23 is rejected under 35 U.S.C. §103(a) as being unpatentable over Nanto '836 in view of Shinoda '553 as applied to Claim 1 and further in view of Igarashi et al. '723.

In Paragraph 18 of the Official Action, Claims 24-25 are rejected under 35 U.S.C. §103(a) as being unpatentable over Nanto '836 in view of Shinoda '553 as applied to Claim

1 and further in view of Yamaura '231, and Mizuno et al. '325.

In Paragraph 19 of the Official Action, Claim 57 is rejected under USC 35 §103(a) as being unpatentable over Nanto '836 and Ravi-Chander'574 as applied to Claim 33 above, and further in view of Shinoda '553.

In Paragraph 20 of the Official Action, Claim 45 is rejected under 35 U.S.C. §103(a) as being unpatentable over Nanto '836 and Ravi-Chander'574 as applied to Claim 33 above, and further in veiw of Silverbrook '241.

We respectfully submit that Nanto '836 is not valid prior art under 35 U.S.C. §102(e) in view of Hilmer and is also not prior art under 35 U.S.C. §103(a). The Applicants were in possession of the claimed invention on December 17, 1996 by virtue of the filing date of their Japanese priority application Serial No. 8-336,713. An English language translation of the priority document was officially filed under date of April 5, 2000. Withdrawal of all rejections based in whole or in part on Nanto '836 is respectfully requested. In any event, because of the amendments, submitted herewith, the differences are not, in any event, such that the subject matter as a whole would have been obvious.

Further regarding Paragraphs 11-21 of the Official Action, and considering any cited prior art alone except Nanto '836, or any combination thereof except with Nanto '836, a person skilled in the art would not consider trying to make a paste applicator with a plurality of holes since all cited prior art except Nanto '836 fail to teach a *paste applicator having a plurality of outlet holes*, which is an essential feature of the claimed invention. In addition, precise manufacture of an applicator with a plurality of outlet holes formed in line *of 288 mm or more*, which makes it possible to apply "a phosphor paste" "onto a substrate having a plurality of barrier ribs formed on it at a pitch of 360μm or less", is not obvious. For example, the linear expansion coefficients of the paste applicator and the plasma display panel would be different from each other. This would present serious problems to a person skilled in the art. Contrary to conventional art, the inventors kept the paste applicator under strict temperature control during its long use and during repeated cleaning. This would have been a disincentive of this invention in the art.

In any event, there is nothing on the record teaching or suggesting a precise printing or coating process using "a paste applicator with a plurality of outlet holes, arranged inline having a length of 288 mm or more". It had not been expected at the time of this invention was made that keeping such a precise dimension of the big paste applicator throughout its length and throughout its life, for coating or printing "onto a substrate having a plurality of barrier ribs formed on it at a pitch of 360μm or less" was practical. Please note that Nanto '836 discloses paste applicators of small size only, which is the level of ordinary skill at the time of this invention was made.

In view of the amendments now in the claims, and the strong factual support officially in the file, we earnestly urge that this application is now in proper form for complete allowance, which is respectfully requested.

Respectfully submitted,

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Marked-Up Version to Show Changes Made to the Specification

Kindly amend the specification as follows:

Page 3, first full paragraph, replace with the following:

However, the methods ~~of~~ using screen printing have a disadvantage since the screen is changed in form by repeated printing, the accuracy is low, making it difficult to form a phosphor layer capable of providing a highly precise plasma display, and also have a problem that the cost is high since the expensive screen must be frequently exchanged.

Page 4, first full paragraph, replace with the following:

We have studied intensively on any means for producing a plasma display free from the above disadvantages, and as a result, completed the present invention described below.

Page 5, first full paragraph, replace with the following:

The method for producing a plasma display of the present invention comprises the step of continuously applying a phosphor paste containing a phosphor powder and an organic compound onto a substrate having a plurality of barrier ribs from a paste applicator having a plurality of outlet holes, to form a phosphor layer. The method for producing a plasma display of the present invention also comprises the steps of coating a substrate with a plurality of barrier ribs, with three phosphor pastes respectively containing a phosphor powder emitting lights of red, green or blue, as strips in the spaces between the barrier ribs on the substrate, from a paste applicator with outlet holes, and heating to form a phosphor layer.

Page 7, the paragraph identified as (16), replace with the following:

(16) Each of the phosphor powders used is 0.5 to 10 μm in grain size, of 50 wt% of the powder, and 0.1 to 2 m^2/g in specific surface area.

Page 8, the paragraph identified as (21), replace with the following:

(21) The phosphor deposited at the top ends of the barrier ribs are removed by adhesion to an adhesive material.

Page 41, the first full paragraph, replace with the following:

If a plurality of paste applicators are installed on the apparatus, for simultaneous coating, coating can be completed efficiently in a short time. In this case, if the plurality of paste applicators are moved at the same speed, uniformly thick coating can be achieved. Furthermore, if three or more paste applicators are installed to apply a paste containing a phosphor material emitting light of one color from each of the three or more paste applicators, then phosphor materials of three colors, red, green and blue can be applied at ~~a~~ one time for coating. Moreover, it is also possible to apply phosphor pastes of three colors from one paste applicator. In this case, if the shortest distance between the outlet holes applying phosphors respectively different in color is kept at 600 μm or more, the mixing of the phosphor of red, green and blue colors can be prevented.

Page 69, the first full paragraph from the bottom, replace with the following:

The red phosphor paste and the paste applicator were used for coating while the distance between the top ends of the barrier ribs formed on the glass substrate and the tips of the outlet holes of the paste applicator was kept at 0.1 mm. During the coating, the paste applicator filled with the phosphor paste was pressurized for continuous application, and moved at a speed of 50 mm/sec ~~in~~ parallel to the barrier ribs.

Bridging pages 69 and 70, replace the paragraph beginning on the last line of page 69 with the following:

After start of coating, a pressure of 2.6 kg/cm^2 was applied in the case of red or blue, or a pressure of 3 kg/cm^2 was applied in the case of green, and when the paste applicator progressed to the end of the substrate, coating was terminated. In this case, at 0.1 second before the paste applicator reached the ends of barrier ribs, a negative pressure was applied to reduce the pressure in the paste applicator. Then, the paste applicator was moved by 42.24 mm in the direction perpendicular to the partitions, and the phosphor paste was

applied. By 10 times of coating, 640 lines were formed in every three spaces between the respectively adjacent barrier ribs. Then, the coating was dried at 80°C for 15 minutes. Similarly, every space between the barrier ribs on the immediate right of each space coated with the red phosphor paste was coated with the green phosphor paste, and every space between the barrier ribs on the immediate left of each space coated with the red phosphor paste was coated with the blue phosphor paste.

Page 74, the first full paragraph, replace with the following:

A phosphor layer was formed as described in Example 1, except that a glass substrate with 2000 barrier ribs with a height of 120 μm and a width of 30 μm formed at a pitch of 150 μm was used, that a paste applicator with 640 outlet holes with a diameter of 80 μm formed at a pitch of 450 μm was used. Accordingly, the applicator had 639 intervals between the holes, and the total length of the line of holes was 639 x the pitch of 450 μm, which is 287.550 mm. The discharge of the red phosphor paste was followed by drying at 80°C for 60 minutes with the coating face down, discharging the green phosphor paste, drying at 80°C for 60 minutes with the coating face down, discharging the blue phosphor paste, drying at 80°C for 60 minutes with the coating face down, and burning at 500°C for 30 minutes. The evaluation results are shown in Table 1.

Clean

~~Marked-Up~~ Version Showing Changes Made to the Claims

Kindly amend the claims as follows:

1. (Twice Amended) A method for producing a plasma display, comprising the step of continuously applying a phosphor paste containing a phosphor powder and an organic compound onto a substrate having a plurality of barrier ribs formed thereon at a pitch of 360μm or less, from a paste applicator with a plurality of outlet holes, arranged inline having a length of 288 mm or more, to form a phosphor layer having a lateral side wall thickness (T1) of the phosphor layer at the position corresponding to a half of the height of each barrier rib and having a bottom wall thickness (T2) of the phosphor layer, wherein the thicknesses (T1) and (T2) satisfy the following relationship:

$10 \leq T1 \leq 50\ \mu m$

$10 \leq T2 \leq 50\ \mu m$

$0.2 \leq T1/T2 \leq 5.$

2. (Three Times Amended) A method for producing a plasma display, comprising the steps of coating a substrate having a plurality of adjacent barrier ribs formed at a pitch of 360μm or less, with three phosphor pastes, each said coating containing a phosphor powder emitting light of red, green or blue, as stripes in the spaces between said respectively adjacent barrier ribs, from a paste applicator having outlet holes formed in line having a length of 288 mm or more, and heating said paste to form a phosphor layer, wherein said layer has a lateral side wall thickness (T1) of the phosphor layer at the position corresponding to a half of the height of each barrier rib and the bottom wall thickness (T2) of said phosphor layer satisfy the following relationship:

$10 \leq T1 \leq 50\ \mu m$

$10 \leq T2 \leq 50\ \mu m$

$0.2 \leq T1/T2 \leq 5.$

3. (Twice Amended) A method for producing a plasma display, according to claim 1 or 2, wherein a space (S) between said adjacent barrier ribs and the average diameter (D) of said outlet holes satisfy the following formula:

$10\ \mu m \leq D \leq S \leq 500\ \mu m$.

7. (Twice Amended) A method for producing a plasma display, according to claim 1 or 2, wherein said paste applicator has a total of $16n \pm 5$, wherein n is a natural number outlet holes.

11. (Twice Amended) A method for producing a plasma display, according to Claim 1 or 2, wherein the average diameter (D) of said outlet holes is 60 to 400 μm.

12. (Twice Amended) A method for producing a plasma display, according to claim 1 or 2, wherein said barrier ribs have top surfaces, and wherein said phosphor pastes are applied while the distance between said top surfaces of the barrier ribs are formed on a glass substrate, and wherein the tip of each said outlet holes of the paste applicator is kept at 0.01 to 2 mm from said top surfaces.

13. (Twice Amended) A method for producing a plasma display, according to claim 1 or 2, wherein phosphor pastes capable of emitting different colors are discharged from one paste applicator, and wherein the shortest distance between the outlet holes that are connected for applying said phosphor pastes that are mutually different in color, is 600 μm or more.

19. (Twice Amended) A method for producing a plasma display, according to Claim 1 or 2, wherein said paste applicator and said substrate undergo movement relative to each other in parallel to the barrier ribs on the substrate, the jet application of phosphor pastes is started, and before that relative movement is stopped, said jet application is stopped.

20. (Three Times Amended) A method for producing a plasma display, according to

Claim 1 or 2, wherein 50 wt% grain size of each of said phosphor powders is 0.5 to 10 μm, and wherein the specific surface area of each of said phosphor powders is 0.1 to 2 m^2/g.

24. (Twice Amended) A method for producing a plasma display in which three phosphor pastes each comprising a phosphor powder emitting light of red, green or blue are applied to the spaces between adjacent barrier ribs on a glass substrate, to form a phosphor plane layer, according to claim 2, wherein phosphor paste existing outside predetermined coating positions are removed from said barriers by adhering said phosphor paste to an adhesive material.

25. (Twice Amended) A method for producing a plasma display, according to claim 1 or 2, wherein phosphor paste deposited at top surfaces of the barrier ribs is removed by adhering said phosphor paste to an adhesive material.

29. (Twice Amended) A method for producing a plasma display, according to claim 28, wherein each of said photosensitive phosphor pastes has the following composition:

Organic component : 15 ~ 60 parts by weight

Phosphor powder : 40 ~ 85 parts by weight

Solvent : 10 ~ 50 parts by weight.

30. (Twice Amended) A method for producing a plasma display, according to claim 1 or 2, wherein said barrier ribs are provided as stripes having the following dimensions:

Pitch : 100 ~ 250 μm

Width : 15 ~ 40 μm

Height: 60 ~ 170 μm.

33. (Three Times Amended) An apparatus for producing a plasma display, comprising a table for fixing a substrate with a plurality of barrier ribs formed on the substrate surface, a paste applicator having a plurality of outlet holes formed in line of 288mm or more to face the barrier ribs of the substrate, wherein the average diameter (D) of the outlet holes of the paste applicator and the length (L) of each of the outlet holes satisfy the following relationship:

$$L/D = 0.1 \sim 600;$$

wherein a phosphor paste supply is operatively connected to the paste applicator, and a moving actuator for three-dimensionally moving and said paste applicator relative to each other; and

a positioning controller operative and effective to adjust the angle of inclination of said paste applicator to top surfaces of said barrier ribs of the substrate, while keeping tips of the outlet holes of said paste applicator at a predetermined distance from the barrier ribs of the substrate.

35. (Twice Amended) An apparatus according to claim 33, wherein the outlet holes of the paste applicator are non-circular in cross section, and the length (B) of each of the holes almost perpendicular to the barrier ribs and a space (S) between the adjacent barrier ribs satisfy the following relationship:

$$10\ \mu m \leq B \leq S \leq 500\ \mu m.$$

44. (Twice Amended) An apparatus according to claim 33, wherein the centers of the outlet holes of the paste applicator are located above the spaces between the adjacent barrier ribs.

49. (Three Times Amended) An apparatus for producing a plasma display, according to claim 33, wherein a plurality of paste applicators are provided for different phosphor pastes, and a plurality of phosphor paste supply devices are provided to supply the phosphor pastes for the respective paste applicators, so that spaces between the barrier

ribs of the substrate may be simultaneously coated with the plurality of phosphor pastes.

51. (Three Times Amended) An apparatus for producing a plasma display, according to claim 33, wherein a detecting means is provided for detecting the positions of the outlet holes of said paste applicator, and wherein a detecting means for detecting the positions of the barrier ribs or the spaces between the barrier ribs of the substrate, a detecting means for detecting the position of top surfaces of the barrier ribs on the substrate, a detecting means for detecting the positions of tips of the outlet holes of the paste applicators, and a control means for controlling the start and end of applying of the phosphor paste in response to the relative positions between the outlet holes of the paste applicators and the substrate, are provided.

55. (Three Times Amended) An apparatus for producing a plasma display, according to claim 33, wherein a reference mark detecting means is provided for detecting a reference mark on the substrate, and wherein a moving means and control means for moving the paste applicator and the barrier ribs relative to each other so that the outlet holes of the paste applicator may be located above spaces between the barrier ribs to be coated with the phosphor paste, are provided.

58. (Three Times Amended) An apparatus for producing a plasma display, comprising three coating devices provided in series to deliver three phosphor pastes are provided, said coating devices each being equipped with a table for fixing a substrate ~~with~~ having barrier ribs, a paste applicator with a plurality of outlet holes arranged to face the barrier ribs of the substrate, a supply means for supplying phosphor pastes to the paste applicator, and wherein a moving means for three-dimensionally moving the table and the paste applicator relative to each other, are provided.